Food niche overlap of three sympatric raptors breeding in agricultural landscape in Western Pomerania region of Poland

Překryv potravních nik káně lesní (*Buteo buteo*), poštolky obecné (*Falco tinnunculus*) a kalouse ušatého (*Asio otus*) v podmínkách zemědělské krajiny západního Pomořanska, Polsko

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ABSTRACT. Diet of Common Buzzard (*Buteo buteo*), Eurasian Kestrel (*Falco tinnunculus*) and Long-eared Owl (*Asio otus*) were investigated using a pellet analysis method in the Gryfice Plain in Western Pomerania region of Poland. Data on food composition were obtained from 26 nest localities. Using a pellet analysis, 470 individuals of insectivores, rodents, birds and insects were identified. Microtinae, especially The Common Vole (Microtus arvalis), were the most important prey of all studied raptor species in this region of Poland. Common Buzzard had the broadest food niche comparing to other studied predators. The niche overlap index was greater when compared Buzzard vs. Kestrel (0.87) and Kestrel vs. Long-eared Owl (0.85), than Buzzard vs. Long-eared Owl (0.74).

INTRODUCTION

Interspecific competition is a common phenomenon, which exerts a crucial influence on natural populations (Chesson & Huntley 1997, Gurevitch et al. 2000). It represents important evolutionary driving factor, which might potentially lead to niche differentiation in sympatric species (Schoener 1982, 1983, 1985, Connell 1983, Sih et al. 1985). Both food resources and hunting habitat are main niche components for predators (Pianka 1973, Schoener 1974). Lundberg (1979) and Newton (1979) assume also breeding habitat as additional niche component related to limited resources in raptors.

Common Buzzard (*Buteo buteo*), Eurasian Kestrel (*Falco tinnunculus*) and Long-eared Owl (*Asio otus*) breeding in Western Pomerania region of Poland prefer agricultural areas for hunting compared to forest patches due to relatively high efficiency in searching for prey. The main aim of this work is to describe the food niche breadth of mentioned above species and estimate the food niche overlap between coexisting raptors.

MATERIAL AND METHODS

Field work has been conducted in 2000-2002 in Western Pomerania region of Poland. Study area (about 120 km^2) comprised forests (32% of total study area), field crops (43%), meadows and wastelands (14%), and built-up areas (11%). Nests occupied by raptors were localized in spring (April-May). Pellets and other prey remains were collected from neighbourhood of raptor's nests during summer (June to August). Prey remains were identified using literature guide (Pucek 1984) and comparative material of feathers and skulls. In total, I collected 176 pellets of Common Buzzard from 12 nests (152 prey items),

112 Eurasian Kestrel pellets from 6 nests (113 prey items) and 157 Long-eared Owl pellets from 8 nests (205 prey items). Due to some absences of bone tissue in material, it was not possible to estimate body mass of each prey. Prey biomass was therefore calculated using assumed digestion indices (Pucek 1984, Busse 1990, Jędrzejewska & Jędrzejewski 1998). Niche breadth index (B) was calculated according to Levins (1968), and niche overlap index (α) was calculated according to Pianka (1973).

RESULTS

Common Buzzard (*Buteo buteo*)

The dominant prey group (over 60% of prey) were rodents (Table 1). The minor prey groups were birds and insectivores. Insects occurred in the diet of the Common Buzzard, although it was not as numerous as in the diet of the Eurasian Kestrel (Table 1). The main prey species was Common Vole, (over 30% of prey items). Birds from small passerines up to the size of pigeon were well represented in the diet compared to the two other raptors (Table 1). Niche breadth index was higher than in two other studied species (B = 7.45). The niche overlap with the Eurasian Kestrel was higher than with the Long-eared Owl (Table 2).

Eurasian Kestrel (*Falco tinnunculus*)

Similar to Common Buzzard, the dominant prey group (over 60% of prey items) consisted of rodents (Table 1). The minor prey groups were birds and insectivores and the supplementary prey group were insects (Table 1). The main prey species was Common Vole (almost 30% of prey items). Bird species hunted by the Eurasian Kestrel were smaller compared to those found in the diet of the Common Buzzard. Although Kestrel was the only raptor with the proportion of insects in prey exceeding 10% of all items, total insect biomass was very low (Table 1). Niche breadth index was intermediate between the values of the Common Buzzard and the Long-eared Owl (B = 5.35). Niche overlap with the Long-eared Owl and the Common Buzzard was almost identical (Table 2).

Long-eared Owl (*Asio otus*)

The only prey group of the Long-eared Owl (100% of prey items) were rodents (Table 1). The main prey species in diet was Common Vole (over 60% in diet). Moreover, Microtinae contributed to over 95% of rodents consumed by Long-eared Owl (Table 1). Niche breadth index was very low (B = 2.41). The niche overlap with the Eurasian Kestrel was higher than with the Common Buzzard (Table 2).

DISCUSSION

It was possible to distinguish the dominant, minor and supplementary prey groups for Common Buzzard and Eurasian Kestrel (Goszczyński 1977, Jędrzejewska & Jędrzejewski 1998). Similar numbers of Common Vole in the diet of Common Buzzard and the Eurasian Kestrel were found in other studies, e.g. 55.6-69.6% for Kestrel in abundant vole years and 40.8-57.5% in low vole years (Korpimäki 1987); 27.0-30.5% for Buzzard (Jędrzejewska & Jędrzejewski 1998). The diet of the Long-eared Owl diet consisted of voles, especially the Common Vole. This high specialization in prey selection seems to be typical for this owl (Goszczyński 1977, Wijnands 1984, Jędrzejewska & Jędrzejewski 1998).

Table 1 – Food composition of three studied raptor species. % prey – percent of defined prey species/group in total sum of prey number taken by each raptor species, % bio - percent of defined prey species/group in total sum of prey mass taken by each raptor species.
Tab. 1 – Složení potravy káně lesní, poštolky obecné a kalouse ušatého ve studované oblasti. % prey – procentuální zastoupení kusů jednotlivých druhů a skupin kořisti v potravě, % bio – procentuální zastoupení biomasy jednotlivých druhů a skupin kořisti v potravě.

Species of prey	Common Buzzard		Eurasian Kestrel		Long-eared Owl	
	% prey	% mass	% prey	% mass	% prey	% mass
Pygmy shrew (*Sorex minutus*)	2.0	0.2	1.8	0.3	-	-
Common shrew (*Sorex araneus*)	5.3	1.1	6.2	2.1	-	-
Mole (*Talpa europaea*)	7.9	17.9	4.4	16.1	-	-
Insectivorous - total	15.1	19.2	12.4	18.5	-	-
Common vole (*Microtus arvalis*)	33.6	24.0	29.2	33.5	66.9	61.1
Root vole (*Microtus oeconomus*)	7.9	8.9	9.7	17.5	6.3	9.1
Field vole (*Microtus agrestis*)	-	-	-	-	2.9	3.2
Unidentified vole (*Microtus* sp.)	11.2	9.9	5.3	7.5	15.6	17.6
Pine vole (*Pitymys subterraneus*)	-	-	5.3	4.1	2.4	1.5
Bank vole (*Clethrionomys glareolus*)	7.2	4.1	6.2	5.7	2.9	3.2
Water vole (*Arvicolla terrestris*)	2.0	6.1	-	-	0.5	1.9
Wood mouse (*Apodemus sylvaticus*)	3.3	1.6	4.4	3.4	0.5	0.3
Harvest mouse (*Micromys minutus*)	-	-	2.7	0.8	-	-
Unidentified mouse (*Apodemus* spp.)	-	-	-	-	2.0	2.1
Rodents – total	65.1	54.6	62.8	72.4	100.0	100.0
Passeriformes – small (*Emberiza* spp.)	6.6	3.1	10.6	8.1	-	-
Passeriformes – medium (*Turdus* spp.)	3.3	4.7	-	-	-	-
Corvids (*Garrulus glandarius*/*Corvus* spp.)	2.6	11.9	-	-	-	-
Pigeons (*Columba* spp.)	0.7	6.1	-	-	-	-
Birds – total	13.2	25.9	10.6	8.1	-	-
Beatles	6.6	0.3	8.0	0.6	-	-
Dragonflies	-	-	6.2	0.5	-	-
Insects – total	6.6	0.3	14.2	1.1		

Table 2 – Niche overlap index (α) of three studied raptor species.
Tab. 2 – Index překryvu potravních nik (α) u káně lesní, poštolky obecné a kalouse ušatého.

Species	Common Buzzard	Eurasian Kestrel	Long-eared Owl
Common Buzzard	1.00	0.87	0.74
Eurasian Kestrel	-	1.00	0.85
Long-eared Owl	-	-	1.00

Studied raptors are generally described as medium or high mammal-specialized predators, which has been confirmed also during this study. Nevertheless, niche breadths of the studied species were quite different. Similar to results of JĘDRZEJEWSKA & JĘDRZEJEWSKI (1998), the Common Buzzard had the widest food niche comparing to the other two studied raptors. The niche breadth of the Eurasian Kestrel was intermediate but higher than described for this species in Finland (KORPIMÄKI 1987). The narrowest niche was observed in Long-eared Owl, which is typical for this raptor (WIJNANDS 1984, KORPIMÄKI 1987, RIGA & CAPIZZI 1999, JĘDRZEJEWSKA & JĘDRZEJEWSKI 1998). According to this study, it has been shown that Long-eared Owl is highly specialized raptor, while Eurasian Kestrel and Common Buzzard were more opportunistic.
Raptors feeding primarily on mammals, especially on small rodents, show high niche overlap (JAKSIĆ & BRAKER 1983, KORPIMÄKI 1987), because they concentrate their hunting on one or two dominant prey species, i.e. voles (GOSZCZYŃSKI 1977) and this could lead to competition for food in simply structured habitats of agricultural landscapes.

SOUHRN

Práce porovnává potravu káně lesní, poštolky obecné a kalouse ušatého v podmínkách zemědělské krajiny západního Pomořanska v Polsku. Výsledky jsou založeny na analýze vývržků z 26 hnízdních lokalit, přičemž celkem bylo identifikováno 470 kusů kořisti (Tab. 1). Hlavní složku potravy tvořili hrabošovití hlodavci (Microtinae), přičemž dominantní kořistí byl hraboš polní (*Microtus arvalis*). Nejvíce specializovaným druhem byl kalous ušatý (95 % potravy tvořili hrabošovití hlodavci, index šířky niky B = 2,41), zatímco potrava káně lesní (B = 7,45) a poštolky obecné (B = 5,35) byla pestřejší. Značný překryv potravních nik (index překryvu nik α, Tab. 2) vykazovaly dvojice káně lesní vs. poštolka obecná a poštolka obecná vs. kalous ušatý, nejmenší překryv nik potom měla dvojice káně lesní vs. kalous ušatý. Studované druhy dravců a sovy, jejichž hlavní složkou potravy jsou drobní hlodavci, vykazují široký překryv potravních nik. Ve studovaném prostředí zemědělské krajiny (pole 43 %, louky a ruderály - 14 %) zaměřují lovecké úsilí na jednu až dvě dominantní složky potravy (hraboše), což může vést ke kompetici o potravu.

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